river currents, constant changes of depth, and many curves of short radius.

Monday is usually devoted to electrical engineering but, as already remarked, there were but two papers approaching that character this year. Mr. Killingworth Hedges contributed a paper on 'The Protection of Public Buildings from Lightning,' remarking that in 1888 the subject had been discussed jointly by the Physicists and Engineers of the Association, but that there had been no official report as to the effect of lightning strokes upon buildings protected by conductors since the Lightning Rod Conference of 1882. In the discussion it was said that architects could not be expected to pay more attention to protection of buildings from lightning until engineers had definitely decided what practice should be followed, there being at present many conflicting views. 'The Commercial Importance of Aluminium' and 'Aluminum as a Fuel,' were discussed respectively by Professor E. Wilson and Sir Roberts-Austen, F.R.S., the former considering chiefly its advantages as an electrical conductor. Mr. J. Dillon described a method of recording soundings by photography, for the use of engineers; Dr. Vaughan Cornish discussed the height and length of waves observed at sea, and Mr. R. L. Jack showed pictures of native bridges in Western China.

Two reports of committees were presented to this Section. Professor H. S. Hele-Shaw made a preliminary report for the Committee on Resistance of Road Vehicles to Traction, from which it appeared that some work had been done with a motor-car and experiments had been made on an artificial track so as to test the resistance of various materials. Mr. W. H. Price reported for the Committee on the Small Screw Gauge that, while it had been recommended last year that the thread of the British Association screw-gauge should be altered in certain particulars, and the proposals had attracted much attention, yet so far the recommendations had had no practical results. Professor G. Forbes explained a portable folding range-finder, for use with infantry, based on the instrument of Adie and utilizing stereoscopic vision. After papers by Mr. Mark Barr, describing his ingenious machines for engraving the matrices used in type-founding, by Mr. C. R Garrard, on 'Recent Development of Chain Driving,' by Mr. T. A. Hearson, on 'Measurement of the Hardness of Materials by Indentation by a Steel Sphere,' by Mr. E. T. Edwards, on 'The Critical Point in Rolled Steel Joists' and by Mr. J. W. Thomas, on 'Air Currents in Churches' the Section adjourned a day before the other sections. Notwithstanding the paucity of papers, they were of fair quality and covered a wide range of subjects.

A. LAWRENCE ROTCH.
BLUE HILL METEOROLOGICAL OBSERVATORY.

SCIENTIFIC BOOKS.

Smokeless Powder, Nitro-cellulose and Theory of the Cellulose Molecule. By JOHN B. BERNADOU, Lieutenant U. S. Navy. N. Y., John Wiley & Sons. 1901.

This work consists of eighty pages of new matter and of one hundred and thirteen pages of translation and reprints. The newly presented portion treats of: (1) Origin of the cellulose nitrates; the names by which they have been sometimes designated; and the meanings that the author gives to the terms he employs; (2) to 'the earlier views as to nitro-cellulose composition and constitution'; (3) to 'the conception of progression in relation to composition and constitution'; (4) to 'solutions of nitro-cellulose' and 'theory of the cellulose molecule.' It will be observed that in this brief space the author has set for himself a most ambitious program, especially as he applies himself to the solution of one of the unsolved problems of chemistry and one which chemists have regarded as presenting the most profound difficulties. Naturally those chemists into whose hands this book may come would turn at once

to the author's 'theory of the cellulose molecule,' curious to ascertain the data upon which the author's theory is based, the methods of reasoning by which he arrives at his conclusions, and the form that his theory takes. He will find that it is based on the statements of Cross and Bevan that in mercerizing cellulose with sodium hydroxide a definite reaction takes place 'in the molecular ratio $C_{12}H_{20}O_{10}$: 2 NaOH accompanied by combination with water (hydration)'; that the compound thus formed is decomposed on washing with water, 'the cellulose appearing in a modified form, viz., as the hydrate $C_{12}H_{20}O_{10} \cdot H_2O$'; that by treatment with alcohol 'one half of the alkali is removed * * * the reacting groups remaining associated in the ratio $C_{12}H_{20}O_{10}$. NaOH'; that the process of mercerization is accelerated 'on exposure to a lye of 1.225 – 1.275 sp. gr.' * * * 'by reduction of temperature,' which, Bernadou states, presents 'an analogy to the increased solubility of nitro-cellulose in ether and ether-alcohol upon application of cold'; that the quantitative regeneration of cellulose from thio-carbonate solutions and the saline character of aqueous solvents of cellulose led Cross and Bevan to express the belief that cellulose yields only under the simultaneous strain of acid and basic groups, and to assume, 'that the OH groups in cellulose are of similarly opposite function,' but 'that apart from any hypotheses, we may lay stress on the fact that these processes (of dissolving cellulose) have the common feature of attacking cellulose in the two directions corresponding with those of electrolytic strain.'

With these data and some few experiments of his own on solubility at low temperatures, Bernadou sets out to demonstrate the constitution of the cellulose molecule. He finds it necessary, however, at the outset to assume that ethyl hydroxide has the constitution which chemists have assigned to dimethyl oxide, and then taking as his empirical formula $C_{12}H_{20}O_{10}$, without giving any experimental data for doing so, he writes the constitutional formula for cellulose as a closed chain with double bonds for the central carbon atoms, notwithstanding that Cross and Bevan (the authority he quotes) in speaking of the celluloses say, on page 2 of 'Cellulose,' 1895: "Their reactions are those of 'saturated' compounds. Their empirical formulæ and relationships to the carbohydrates of lower molecular weight further indicate 'single-bond' linking of their C atoms as exclusively prevailing." On page 81 of 'Researches on Cellulose,' 1901, Cross and Bevan give a ring formula for cellulose as proposed by Vignon, but it is quite different from any given by Bernadou and the recent experimental data which suggest such an arrangement are cited. Having thus obtained a 'satisfied' molecule, Bernadou notes that the existence of the 'double central carbon bonds' permits the formula for the molecule, '*on its entering into combination*,' to be written with its four 'ethylene' bonds as linking, and then that, 'without radical modification,' these median bonds may be terminal. By now splitting this last molecule transversely he obtains the formula for his $C_6H_{10}O_5$, which he states 'is the simplest expression for cellulose' and 'represents not the molecule, but the type unit of cellulose as it enters into combination through its four free single carbon bonds,' and with this 'type unit' he proceeds to build 'polymers' exhibiting his 2-phase and 5-phase molecules, the latter being a cycle.

Of these he says, "It is evident that under such an assumption the molecule may possess an infinity of phases. On this assumption, and, it seems to me, on this assumption only, may we account for definite chemical composition of the cellular form in the plant structure. For we may regard the cell as built up from an aggregate of molecules of identical composition but of progressively varying numerical phase. The cell may begin with molecules of low phase and end with molecules of high phase, or conversely."

Again, "The conventional ring-formed combination of elemental particles shown in the polyphase molecule strongly suggests the vortex-ring theory of the composition of matter (as applicable to the *molecule*)."

And again, "Such a molecule would increase in amplitude according to the number of elemental particles entering into its composition; and the thought suggests itself that *progressive variation in the amplitude of the molecular ring is a characteristic of organic life.* Or, conversely, we may state that we may seek for the beginnings

of organic life—or at least of plant life—in the polymerization of the carbohydrates."

Lieutenant Bernadou seems to misconceive the meaning and value of graphic formulæ, for while chemists hold that they are simply convenient conventional methods for expressing the ascertained facts of chemistry, and true only to the extent that they express those facts, Lieutenant Bernadou appears to regard them as original sources of information.

The useful portions of this book are the translations of the papers of Vieille and of Bruley on the Nitration of Cotton, and that of Mendeléef on Pyrocollodion Smokeless Powder, though the value of the last is lessened by the omission of all reference to the source from which it is drawn, especially as the author states in the preface that these are only 'translations of certain portions of their works on explosives.' It should be understood that while translations are a convenience, one who differs from an author should not rely upon a translation, but should first consult the original publication before expressing this difference, and the translator should be willing to have this comparison of his translation readily made by giving his sources.

The record of the results of a few experiments on the solubility of cellulose nitrates at low temperatures in continuation of the work of McNab is interesting. If Lieutenant Bernadou had but multiplied these experiments and reported them in a simple manner he would have produced something more useful to mankind than the speculative essay he has chosen to present. CHARLES E. MUNROE.

Select Methods of Food Analysis. By HENRY LEFFMANN and WM. BEAM. Philadelphia, Pa., Blakiston's Son & Co.

It is stated by the authors that "this book is intended to be a concise summary of analytic methods adapted to the needs of both practicing analysts and advanced students in applied chemistry."

The first part of the work, pages up to 68, is occupied with a brief description of the principal analytic methods employed, including spectroscopy, microscopy, polarimetry, methods of determining melting and boiling points and other general operations.

In the part given to applied analyses, comprising the rest of the book, are articles devoted to general methods for the examination of poisonous metals, colors and preservatives, while under special methods are treated the processes for determining carbohydrates, fats and oils, milk and milk products, tea, coffee and cocoa, condiments and spices, alcoholic beverages and flesh foods.

An appendix contains tables of specific gravities of water, conversion tables for thermometric degrees, tables of elements, symbols, and atomic weights, and plates showing the structure of tea leaves and starches.

In regard to the analytical methods the authors say: "The bulletins of the United States Department of Agriculture (Bureau of Chemistry) and of the Association of Official Agricultural Chemists are now nearly all out of print and scarce. The present work contains a large amount of the data and processes given in those publications, together with data from reports of some of the State agricultural experiment stations."

In addition to this general acknowledgment, the articles copied directly from the above publications are credited in the text in most cases. The authors have reproduced the plates of tea leaves and starch granules of the Bureau of Chemistry, of the Department of Agriculture, stating that the originals in many cases have been retouched by Dr. Beam.

The work is illustrated with 53 figures in addition to the plates of leaves.

This work will prove of great help to analysts who do not have access to the literature of the subject or who have not the time to make their own investigations thereof. The matter is well arranged and classified and in convenient form for reference. H. W. WILEY.

The History of Medicine in the United States, etc., to the Year 1800. By FRANCIS RANDOLPH PACKARD, M.D. J. B. Lippincott Co., Philadelphia. 1901. 8vo. Pp. 542. Illustrated.

The difficulties to be encountered in writing a history of early medicine in America have hitherto deterred authors from attempting this really herculean task, and it is not surprising, therefore, that we find Dr. Packard, in this hitherto untrodden field, claiming for his work